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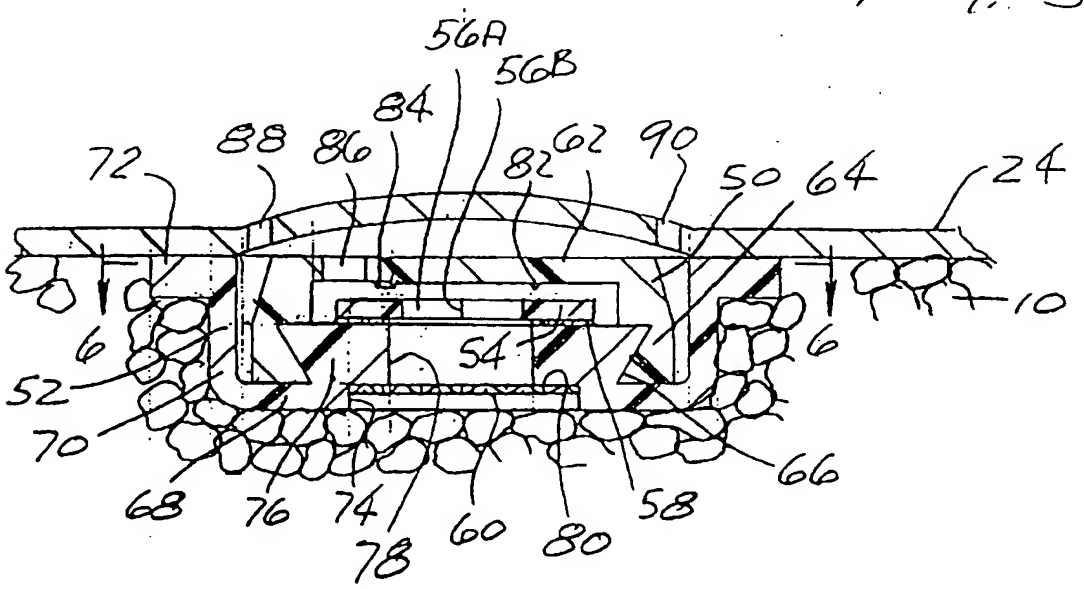
(54) Hermetically sealed package provided with a vacuum relief valve

(57) A sealed package (20) has a compartment (12) to hold contents under hermetic seal, a valve (22) being present in a wall of the package for gas transfer between the compartment and the atmosphere, the valve including auxiliary means such as slits (56) arranged to transfer a limited volume of gas into the compartment.

FIG. 3



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Description

The invention relates too flexible packages and more particularly packages for holding contents in hermetically sealed condition. Packages for holding coffee under vacuum are disclosed in US-A-4,576,285, US-A-4,705,174 and US-A-4,913,561.

One common flexible package for holding goods under vacuum until the package is opened is the so-called "gussetted" package or bag. Typically such a package is formed from a web of flexible stock material, e.g. polyethylene, polyester, polypropylene, metal foil, and combinations thereof in single or multiple plies, into a tubular body, having a face panel, a back panel and gussetted sides. Each gussetted side is formed by a pair of gusset sections and a central fold edge interposed between a pair of outer fold edges. The lower end of the bag is permanently sealed, e.g. heat sealed, along a line extending across the width of the bag close to its bottom edge. The top of the bag is sealed across the entire width of the bag in a number of ways to maintain the contents under vacuum until the bag is opened. Such action is frequently accomplished via a readily openable mouth, which when opened provides access to the contents of the bag.

One-way degassing valves can be present in the wall of flexible packages to enable any gases produced by the particulate material within the package to exit from the package, while preventing air from entering into the package through the valve. Examples of such one-way degassing valves are disclosed in US-A-3,595,467, US-A-3,799,427 and US-A-4,420,015.

One drawback of many commercially available vacuum sealed flexible packages is that when the package is filled, sealed and evacuated the material forming the walls of the package intimately engages the particulate material disposed therein, thereby resulting in an uneven, bumpy, pebbly or otherwise less than satisfactory aesthetic appearance. In US-A-4,727,706 there is disclosed a hermetically sealed flexible packaging, having a smooth aesthetically pleasing appearance. That package basically comprises an inner bag and an outer bag, each bag having a wall of flexible gas resistant sheet material. The outer bag is secured to the inner bag by adhesive areas which define passageways therebetween through which air from the ambient atmosphere may flow to enter the space between the outer and inner bags. The inner bag is filled with a particulate material and then the bag vacuumised and sealed, whereupon the walls of the inner bag closely conform to the surface of the particulate material. The air-filled air space between the inner and outer bag provides a smooth aesthetically pleasing appearance.

Manufacturers of other types of hermetically sealed flexible packages can perforate the package to release trapped air for stacking and shipping. This practice allows the air within the package to be expelled to prevent the package from "pillowing". Such pillowing is undesirable, particularly with relatively large packages, i.e. 11 kg. or more, since it can adversely affect the package's ability to be stacked in a stable manner, one on top of another. Of course, perforating the hermetically sealed package reduces, if not destroys, the effectiveness of the hermetic seal.

For many applications, e.g. packaging of agricultural chemicals or other industrial particulate materials, the hermetically sealed package can exhibit a pebbly unsmooth appearance yet still be acceptable, since appearance of the packaging is typically not a factor in industrial applications. Where, however, relatively large packages of particulate materials are intended for personal or home use, e.g. large bags of dry pet foods, the appearance of the package becomes important insofar as marketability is concerned.

Accordingly, a need exists for packaging which is simple in construction, relatively low in costs, and which provides the advantages of conventional hermetically sealed packaging, while providing an aesthetically pleasing smooth external appearance.

According to the invention in one aspect there is provided a sealed package having walls defining a compartment to hold contents under hermetically sealed conditions, valve means being present in a wall to transfer gas between the compartment and the atmosphere characterised in that the valve means includes auxiliary means 56 arranged to release a limited volume of atmosphere gas into the compartment to provide the walls with a smooth appearance.

US-A-3799427 discloses a flexible package having a hole in a wall, the valve means extending through the hole in the wall, the valve means comprising a cap having a hole therein, the cap overlying a base member having a passageway communicating with the interior of the package, a resilient disc overlying the passageway and being connected to the base member by a viscous layer, the disc being arranged to be lifted off the base member when the pressure within the compartment exceeds that of the atmosphere. It is a preferred feature of the invention that a hole is present in a wall of the package and the valve means is located behind the hole, the valve means comprising a cap having a hole therein, the cap overlying a base member having a passageway communicating with the compartment, a flexible disc overlying the passageway and being connected to the base member by a viscous layer, the disc having slits therein, the disc being arranged such that when the pressure within the compartment exceeds that of the atmosphere the disc lifts off the base member with the slits closed to pass gas from the compartment to the atmosphere via the passageway holes in the cap and in the wall until the pressures are substantially the same.

Preferably the valve is arranged to admit sufficient air to present a package containing particles with a smooth wall.

Preferably the disc is arranged such that when the pressure within the compartment is less than that of the

atmosphere, the disc flexes in to open the slits towards the passageway to direct atmosphere gas to the compartment via the holes in the wall and in the cap and the passageway 78.

Preferably the underside of the cap has downward projections overlying the disc.

Preferably the slits extend the depth of the flexible disc. Preferably the flexible disc is made of polyisobutylene rubber.

It is a preferred feature of the invention that the package is dimensioned to hold about 11 kg of particulate material in the compartment thereof.

It is another preferred feature of the invention to provide a stable column of packages as defined, each containing contents in its compartment. Preferably the packages are arranged so that the valve means of one package is covered by the overlying package.

In order that the invention may be well understood it will now be described by way of example with reference to the accompanying diagrammatic drawings, in which:

Figure 1 is an isometric view of a filled and sealed package wherein the surface of the package is smooth;

Figure 2 is an isometric view as Figure 1 but showing the package, exhibiting its pebbled appearance and before reaching its static equilibrium state;

Figure 3 is an enlarged transverse sectional view, taken through the valve of the package of Figure 1 during its static equilibrium mode shown in Figure 1;

Figure 4 is an enlarged transverse sectional view, as Figure 3, but showing the valve during the vacuum release mode;

Figure 5 is an enlarged sectional view, as in Figures 3 and 4, but showing the valve in pressure relief state to allow gases exhaust;

Figure 6 is an enlarged plan view of the valve taken along line 6-6 on Figure 3; and

Figures 7 to 9 are isometric views of three different embodiments of a disc component of the valve.

A flexible package 20 shown in Figure 1 comprises a gussetted bag having a pressure-equalising, one-way degassing valve 22 mounted in its front wall (as will be described later). The bag 20 has a compartment 12 arranged to hold any particulate material 10 (Figs. 3 to 5), e.g. coffee beans, ground coffee, dry pet food, chemicals, and the like. The bag is dimensioned to hold large amounts of such materials, e.g. in excess of 11 kg, although it can be used for packaging small amounts of such materials also.

The bag 20 comprises a front wall or panel 24, a rear wall or panel 26, a pair of identical gussetted sides 28, a top end portion 30, and a bottom end portion 32. The top end portion 30 of the package terminates in a top marginal edge 34. The bottom end portion 32 terminates in a bottom marginal edge 36. The degasing valve 22 is mounted in the front panel 24, although it can be located in the rear panel as well, and is in communication with the compartment 12 of the bag 20. This small amount of air is enabled to enter the package during a transient mode of operation until the package reaches its equilibrium state, at which time the walls of the bag move out of close conformance to the package's particulate material contents so that the walls exhibit a smooth exterior, as will be described later.

The front panel 24, rear panel 26, and the two gussetted sides 28 of the bag are formed from a single sheet or web of the flexible material, of single or multiple ply or layers, which has been folded and seamed to form a tubular body. Particularly useful flexible material for the bag 20 are commercially available from Fres-Co System USA, Inc., of Telford PA.

In a preferred embodiment the package has a peelable mouth formed by a peelable seal line 38 between the abutting walls to enable the walls of the package at the mouth to be readily peeled apart to open the mouth.

The rear panel 26 of the package 20 includes a fin 40 which extends longitudinally along the back of the package from the top edge to the bottom edge. The fin 40 is located approximately midway between the gussetted sides 28 and is formed by portions of the web material contiguous with the vertical marginal edges of the sheet or web which are brought into engagement with each other and are secured to one another via any conventional sealing technique, such as heat sealing or welding. The fin is generally folded down so it lays substantially flush with the rear wall 26 of the bag.

The bag 20 is arranged to be initially hermetically sealed closed along seal line 38, the peelable seal line 38 after it has been filled and vacuumised.

The bottom end 32 of the bag is sealed closed along a transverse, permanent seam line (not shown) closely adjacent the bottom edge 36. The permanent seam line is formed using any conventional sealing technique, such as that used for the vertical seamed fin 38.

When the bag 20 is filled, vacuumised, and sealed its particulate contents 10, will be kept isolated from the ambient air by the seal line 38. When the vacuumised, the higher pressure outside the package urges the material forming the walls 24,26 and 28 to closely conform to the particulate material 10 within the package. This results in a somewhat, pebbly, uneven, rough or generally less-than-optimum aesthetic appearance, such as shown in Figure 2. The package can, however, be readily stacked horizontally in multiples to form a stable column, since there will be no air or other gases trapped within the package which would otherwise cause an un-

stable "pillowed" condition. M[illegible]er, the weight of the stacked packages, plus the close conformance between the valve on one package and the abutting wall of the abutting package will effectively cover the valve to help maintain the hermetical seal. At this time the valve is operating in its "pressure release mode". Any gases which are produced by the material 10 within the package are able to vent to the exterior in a normal manner (as will be described later).

When the package 20 is removed from the stack, the valve 20 assumes its transient "pressure relief state" because it is no longer under pressure from adjacent packages. In this transient state a small amount of air is permitted to gain ingress into the package over an extended period of time, until the valve reaches its "static equilibrium state". In this latter state the walls of the package will have moved out of intimate engagement with the particulate materials and thereby produce a smooth exterior appearance which is aesthetically pleasing. Once the static equilibrium state has been reached the valve remains in this state and no further air can enter the package. If, however, any gases produced within the package by its contents 10, raise the internal pressure within the package so that it exceeds the external pressure, the valve assumes its pressure release mode to allow the internal gases to vent, while precluding the ingress of air into the package.

The construction and operation of the valve 22 will now be discussed with reference to Figures 3 to 9. As shown in Figure 3 the valve 22 comprises a cap 50, a plate or base member 52, an elastomeric, e.g. rubber, disc 54 having at least one slit 56 therein, a thin layer of oil 58, e.g. a silicone oil, and a filter member 60. The cap member 50 is a generally cylindrical body having a planar circular top wall 62 and a circular slightly conical side wall 64 terminating at its bottom in an undercut annular groove 66. The base member 52 is a generally cup-shaped body having a planar circular bottom wall 68 and a circular sidewall 70 terminating at its top in an annular flange 72. The bottom wall 68 includes a central opening or hole 74 having an annular flange 76 and projecting up from the interior surface of the bottom wall 68. The annular flange 76 is undercut on its exterior surface to be received in and mate with the undercut groove 66 in the cap member 50. A central passageway 78 is provided in the flange 76 and is smaller than the hole 74 to form a ledge 80 on which the filter member 60 is disposed and secured, e.g. glued.

The undersurface of the top wall 62 of the cap member includes a pair of projections or nibs 82 and 84 extending slightly downward. The projection 82 is of circular shape as shown in Figure 6, while the projection 84 is of arcuate shape. These projections serve as "disc contact points" to space the disc from the ceiling of the cap member. The top wall of the cap member includes a small hole 86 immediately adjacent the arcuate nib 84.

The disc member 54 is a planar circular element having at least one slit therein. In Figure 7 there is shown a disc member 54 havi[illegible]air of slits 56A and 56B which are of the same length and disposed perpendicular to each other to form an X-shaped configuration. The slits extend through the entire thickness of the disc and form between them four generally triangular displaceable areas or fingers. In Figure 8 there is shown a disc 54^1 having three slits $56A^1$, $56B^1$ and $56C^1$ which are disposed at 120^0 from one another to form a generally Y-shaped configuration, with three generally triangular displaceable areas or fingers disposed therebetween. In Figure 9 there is shown a disc 54 "having a single slit 56A". This slit forms a pair of displaceable areas on either side of the slit.

The disc 54 (or 54^1 or 54") is disposed on the top surface of the annular flange 76 so that the slit(s), e.g. 56A and 56B are disposed over the central passageway 78 and 74 in the base member. A thin layer of the silicone oil 58 is interposed between the disc 54 and the surface on which it is disposed. That surface forms the seat of the valve 22. The cap member is arranged to be snap fit on the base member to form a hollow interior, with the disc member 54 and oil layer 56 being disposed therein.

The flange 72 secures the valve 22 to the front wall 24 of the package 20 welded or heat sealed about its entire top surface. A pair of small apertures or holes 88 and 90 is present in the front wall 24 of the package within the bounds of the seal line extending around the flange 72 (or a large opening can be provided in the wall 24 to make up the entire area within the bounds of the flange 72).

Preferably the cap 50 and base 52 are injection moulded of polyethylene or the like. The disc 54 is stamped from a sheet of polyisobutylene rubber or the like. The filter 60 comprises a circular disc or sheet of non-woven, heat-sealable filter paper.

The valve 22 is assembled by placing a drop of silicone oil 58 on the top surface of the flange 76 of the base 52 and placing the rubber disc 54 on top of the silicone oil such that the oil forms a seal between the base and the disc. The cap 50 is then placed, e.g. as a snap fit, onto the base. The filter paper 60 is sealed to the underside of the ledge 80 of the base. The valve 22 is mounted in the front panel 24 of the package 20 via a flange 72 on the interior side of a flexible package so that the exterior side of the valve is positioned toward the exterior side of the package 20 and the interior side of the valve is positioned toward the interior of the package. The small holes 86 and 90 (or other cuts, not shown) are made in the front panel 24 of the package within the perimeter of the sealed flange 72 so that air or other gases can pass through the package 20 and out through the valve 22 during its various modes of operation as will be described later.

Two mechanisms are relied upon for the valve 22 to operate. In particular, the elastic nature of the rubber disc 54 enables the area portions of the disc between adjacent or contiguous slits to flex independently of other portions of disc between or adjacent other contiguous

slits. When the rubber disc 54 [illegible]ed during operation of the valve, a gap is created at the interface of the slits 56 and through which outside air can pass. The elastic nature of the rubber disc also serves to effect the automatic reclosure of the slits and to keep the slits closed and impermeable to oxygen, moisture, and odours when the disc is unflexed and flat. The viscous nature of the silicone oil serves to create a seal between the valve seat of the base member and the rubber disc which is impermeable to atmospheric gases, (e.g. oxygen), moisture and odours. The filter paper 60 covers passageway 78 in the base to protect the valve mechanism from being contaminated by particles of the product 10 in the package.

The valve 22 has three modes of operation. In the first mode of operation of the valve 22 shown in Figure 5 and called "pressure release mode" the pressure in the interior of the package is higher than the pressure on the exterior of the package. In this situation, the valve functions to equalise the interior and exterior pressures by allowing the higher internal pressure to break the elastic bond between the valve seat (top surface of flange 76), the silicone oil 58, and the rubber disc 54, allowing air to escape in the direction of arrows 92 through the passageway 78, past the disc 54 and out of the valve through the hole 86 in the cap member. From there the air escapes through the holes 88 and 90 in the front panel 24 of the bag. Additional air may also escape through the slits in the disc which, when presented with a pressure differential, becomes concave in the direction toward the lower pressure, thus flexing the disc toward the exterior of the package which opens the slits and allows air to pass through the base member's orifice, through the flexed slits, through the hole 86 in the cap member 50, and out of the package 20.

Once sufficient air has been released to equalise the internal and external pressures, the disc 54 automatically returns to the normally flat, unflexed state, shown in Figure 3, whereupon the slits are closed, i.e. in abutment with each other. The surface tension of the silicone oil 58 reseals the bond between the valve seat, i.e. top surface of flange 76 of the base member 52, and the disc 54. Thus, the valve 22 switches from the "pressure release" mode to the "static equilibrium mode".

The second mode of operation is shown in Figure 4 and is referred to as the "vacuum release mode". This mode of operation occurs when the pressure in the interior of the flexible package is lower than the pressure on the exterior of the package. In this situation, the valve functions to equalise the interior and exterior pressures by allowing the disc 54 to flex toward the lower pressure thus towards the compartment 12. This opens the slits in the disc and allowing air to pass in the direction of arrows 94 through the apertures 88 and 90 in the front wall of the bag, through the passageway 78, and into the interior of the package 22. Once sufficient air has been released into the package to equalise the internal and external package pressures, the valve stops operating in the vacuum rele[illegible]ode and begins operating in the "static equilibrium mode" shown in Figure 3. In this situation the rubber disc 54 remains sealed to the valve seat by the viscous nature of the silicone oil 58. The equal pressures maintain the disc in a flat, unflexed position, thus keeping the slits closed and the contents of the compartment impermeable to external, atmospheric gases, (e.g. oxygen), moisture, or odours. In this mode, the walls of the package are smooth, as shown in Figure 1. Thus the invention provides a valve which allows a flexible package to be completely and hermetically sealed in order to protect the package's contents against external gases during the large majority of time when internal and external package pressures are at equilibrium. The valve provides a viable means for releasing entrapped air in the package so that the package can be stacked and transported with similarly constructed packages, effectively and economically. Thus the invention enables the creation of a soft, easy to handle, well shaped, aesthetically pleasing, and durable package by enabling the vacuum therein to be released during shipment.

Claims

1. A sealed package (20) having walls (24,26,28) defining a compartment (12) to hold contents (10) under hermetically sealed conditions, valve means (22) being present in a wall to transfer gas between the compartment (12) and the atmosphere characterised in that the valve means (22) includes auxiliary means (56) arranged to release a limited volume of atmosphere gas into the compartment (12) to provide the walls with a smooth appearance.

2. A package according to Claim 1, wherein a hole (88,90) is present in a wall (24) of the package (20) and the valve means (22) is located behind the hole (88,90); the valve means (22) comprises a cap (50) having a hole (86) therein, the cap (50) overlying a base member (52) having a passageway (78) communicating with the compartment (12), a flexible disc (54) overlying the passageway (78) and being connected to the base member (52) by a viscous layer (58), the disc having slits (56A,56B,56C) therein, the disc (54) being arranged such that when the pressure within the compartment (12) exceeds that of the atmosphere the disc (54) lifts off the base member with the slits (56A,56B,56C) closed to pass gas from the compartment (12) to the atmosphere via the passageway (78), holes (86) in the cap (50) and (88,90) in the wall (24) until the pressures are substantially the same.

3. A package according to Claim 2, wherein the valve (22) is arranged to admit sufficient air to present a package (20) containing particles (10) with a

smooth wall.

4. A package according to Claim 2 or 3, wherein the disc (54) is arranged such that when the pressure within the compartment (12) is less than that of the atmosphere, the disc (54) flexes inwards to open the slits (56A,56B,56C) towards the passageway (78) to direct atmosphere gas to the compartment (12) via the holes (88,90) and (86) and the passageway (78).

5. A package according to any preceding Claim, wherein the underside of the cap (50) has downward projections (82,84) overlying the disc (54).

6. A package according to any of Claims 2 to 5, wherein the slits (56) extend the depth of the flexible disc (54).

7. A package according to any of Claims 2 to 6, wherein the flexible disc (54) is made of polyisobutylene rubber.

8. A package according to any preceding Claim, dimensioned to hold about 11 kg of particulate material in the compartment (12) thereof.

9. A stable column of packages according to any preceding Claim, each containing contents (10) in its compartment (12).

10. A column according to Claim 9, wherein the packages are arranged so that the valve means of one package (22) is covered by the overlying package.

FIG. 1

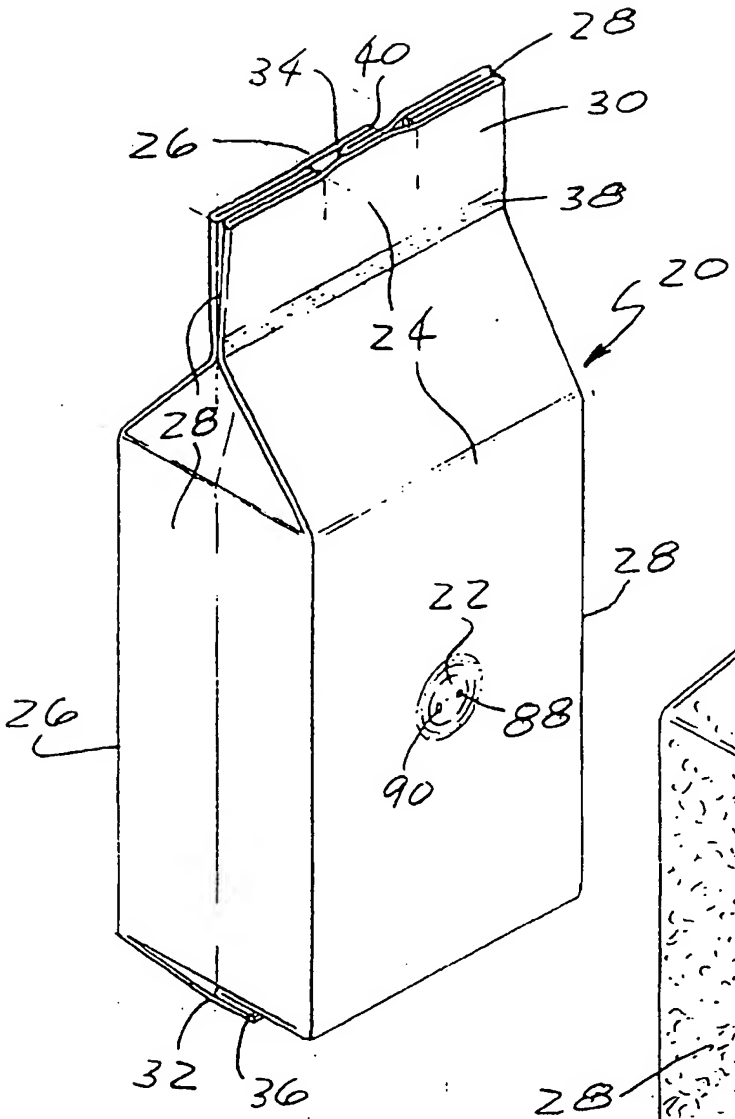


FIG. 2

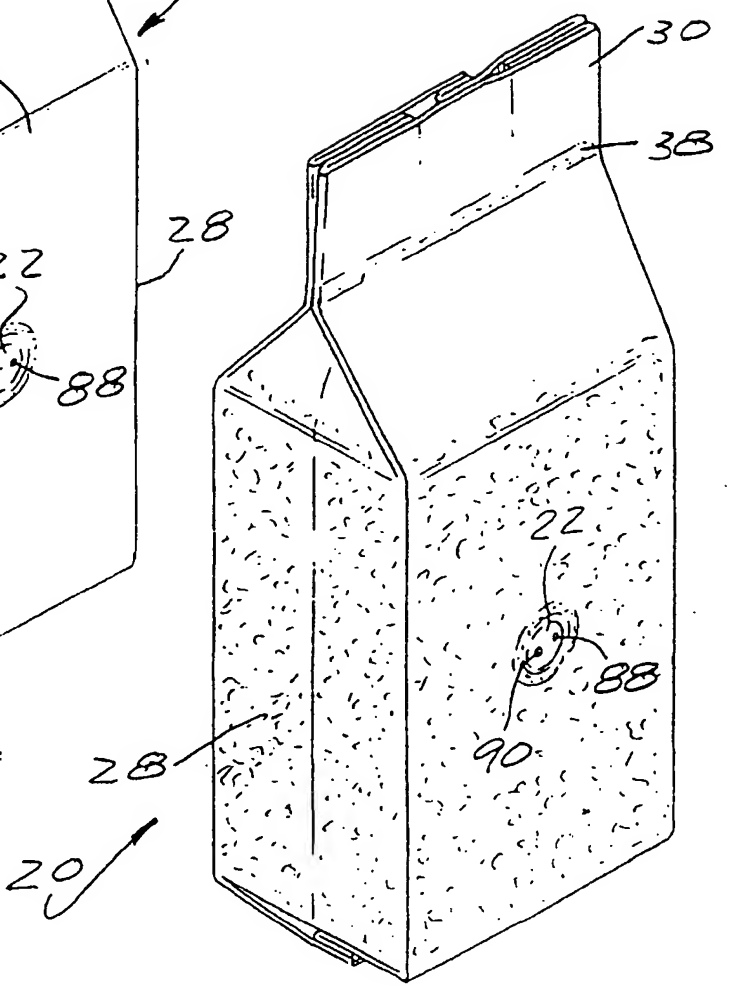


FIG. 3

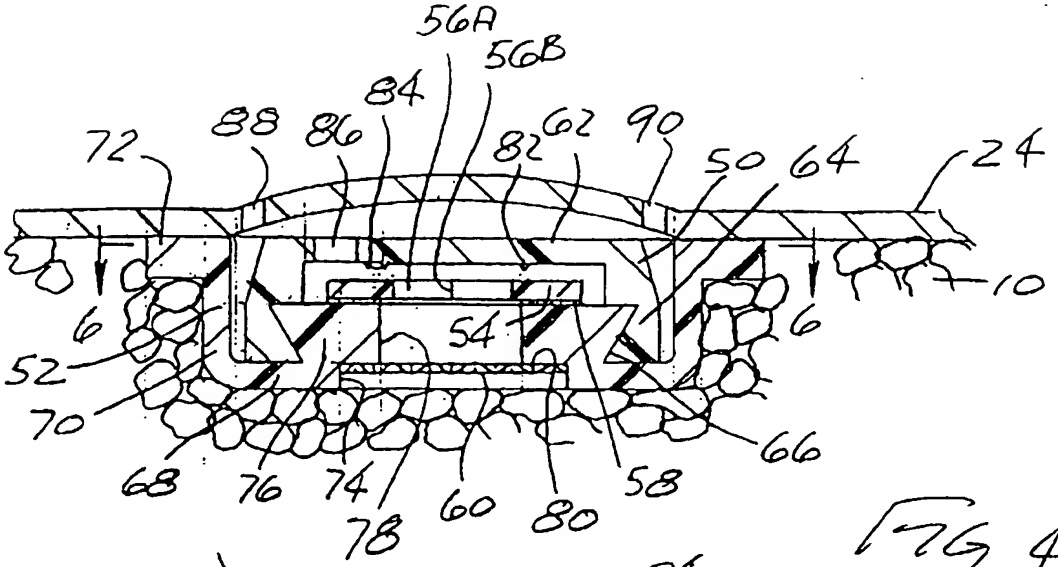


FIG 4

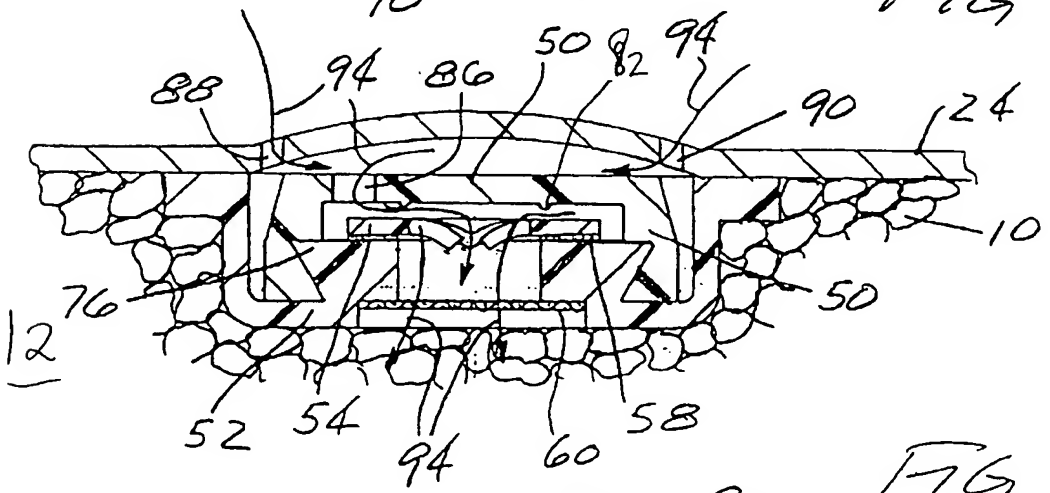


FIG. 5

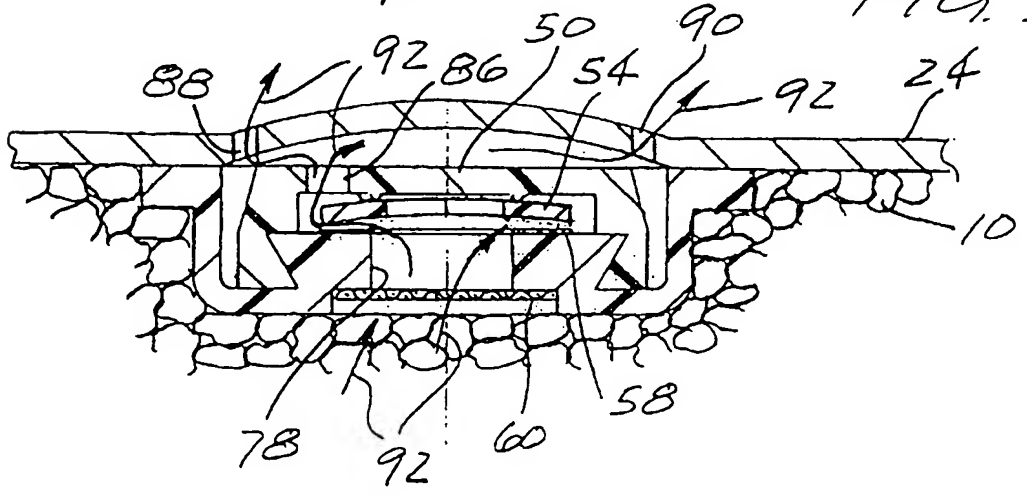


FIG 6

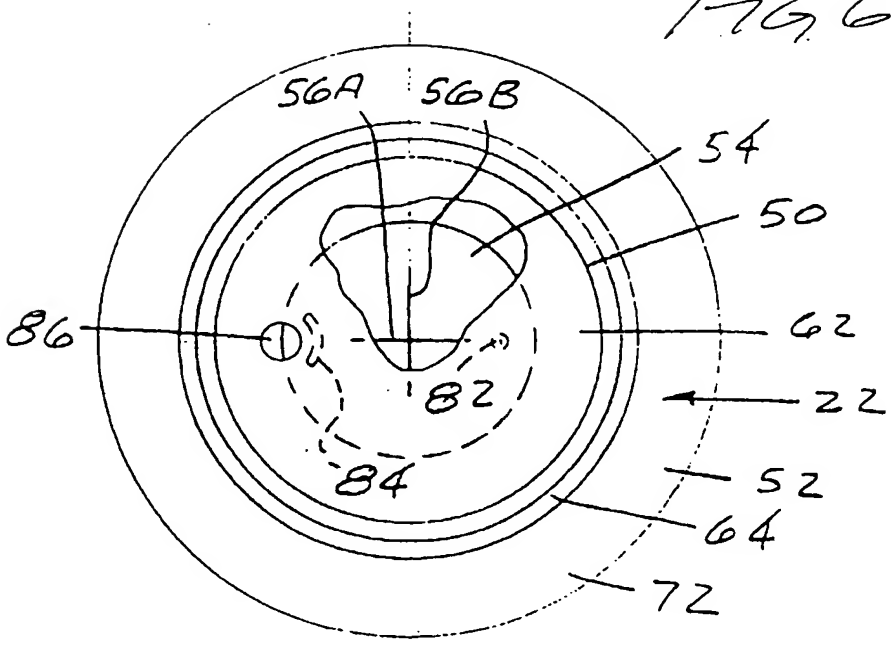


FIG 7

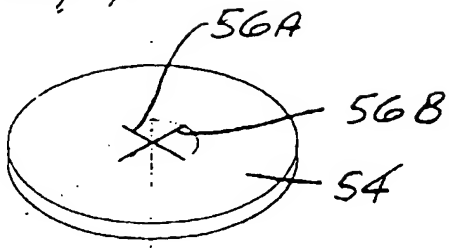
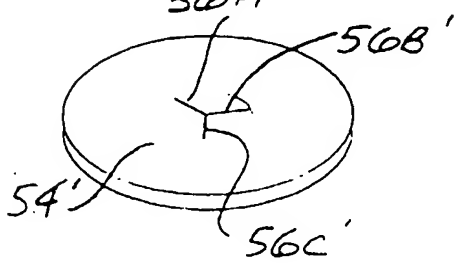


FIG 8



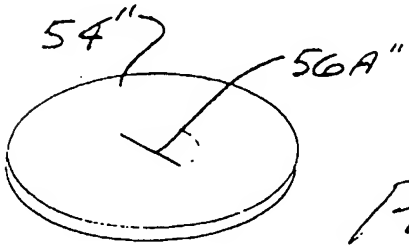


FIG 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 30 2730

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 4 181 146 A (GOGLIO) 1 January 1980 * column 1, line 45 - column 3, line 20; figures 1,3 *	1,5	B65D77/22
X	FR 2 583 386 A (SARTEC) 19 December 1986 * page 5, line 4 - line 35; figures 1,2 *	1	
A,D	US 4 420 015 A (BLASER) 13 December 1983 * column 2, line 65 - column 3, line 31; figure 1 *	1	
A,D	US 3 595 467 A (GOGLIO) 27 July 1971 * column 1, line 4 - line 57; figures 1-3 *	1	
X	DE 24 54 248 A (FR. HESSER MASCHINENFABRIK) 20 May 1976 * page 4, line 12 - page 6, line 19; figures 1-3 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) B65D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	2 July 1998	Berrington, N

CATEGORY OF CITED DOCUMENTS

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